Remarks

Initially, it is noted that on page 2 of the Office Action dated December 2, 2004, the Examiner acknowledged the claim for priority. However, it is respectfully requested that the Examiner indicate such on the next Office Action summary form by checking the appropriate boxes in section 12.

It is also noted that the Examiner has returned a copy of the form PTO-1449 originally submitted to the Patent Office with an Information Disclosure Statement on July 25, 2003. However, it appears that the Examiner has inadvertently failed to initial next to the two references listed on the form. Therefore, it is respectfully requested that the Examiner return an initialed copy of this form PTO-1449.

Further, the returned copy of the form PTO-1449 originally submitted to the Patent Office with an Information Disclosure Statement on August 23, 2002 does not have the Examiner's initials next to the third reference listed in the "Foreign Patent Documents" section of the form. Therefore, it is respectfully requested that the Examiner return a completely initialed copy of this form PTO-1449.

Claims 1 and 2 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Forrest (US 4,709,413) in view of Marcuse (US 5,699,464) and Cunningham (US 6,304,352). Claims 3-5 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Forrest in view of Marcuse. Claims 6-8 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Forrest in view of Marcuse and Auracher (US 3,980,392). Claims 9-11 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Forrest in view of Marcuse and Cunningham and further in view of Auracher.

The above-mentioned rejections are respectfully traversed and submitted to be inapplicable to the claims for the following reasons.

Claim 1 is patentable over the combination of Forrest, Marcuse and Cunningham, since claim 1 recites an optical transmission system having, in part, a transmitter with at least one lens for converging an optical signal generated by a light emission element, wherein a vertex of the at least one lens is located at a predetermined distance from an input plane of a multi-mode fiber, the

predetermined distance being greater or less than a distance from the vertex of the at least one lens to a focal point of the at least one lens, and the predetermined distance is selected based on an eye opening factor of the multi-mode fiber and a power of the optical signal. The combination of Forrest, Marcuse and Cunningham fails to disclose or suggest this feature of claim 1.

Forrest discloses a single-wavelength, bidirectional, fiber optic system having a pair of terminals 10 and 12 linked by a transmission fiber 14. Each of the terminals 10 and 12 is a transceiver which is capable of generating and receiving radiation at the same wavelength. Each of the terminals 10 and 12 includes a photodiode 22 having an active region 26 for receiving radiation, a light source 16 for transmitting radiation, a lens (coupling means) 30 for coupling the radiation from the light source 16, through a hole 32 in the photodiode 22, into the fiber 14. (See column 3, line 11 - column 4, line 49 and Figures 1 and 2).

Based on the above discussion and the illustration of Figure 2, it is apparent that the lens 30 is positioned with respect to the fiber 14 such that the focal point of the lens 30 does not correspond with an input plane of the fiber 14. However, as admitted in the rejection, Forrest fails to disclose or suggest that the distance between the lens 30 and the input plane of the fiber 14 is selected based on an eye opening factor of the fiber 14 and a power of the radiation transmitted by the light source 16. As a result, Marcuse or Cunningham must disclose or suggest this feature in order for the combination of Forrest, Marcuse and Cunningham to render claim 1 obvious.

Regarding Marcuse, it discloses a system having a multimode fiber 60 terminated by fusion splicing a length of homogeneous glass 61 onto the end of the fiber 60. A lens 62 is attached to the end of the glass 61 opposite to the fiber 60. The insertion of the glass 61 between the fiber 60 and the lens 62 moves the end of the fiber 60 away from the lens 62, which allows the lens to form a real image. Further, the glass 61 acts to capture almost all of the optical energy emitted by the fiber 60 and focuses the energy at a point. (See column 3, line 2 – column 4, line 31 and Figure 6).

While Marcuse discloses the use of the glass 61 as a spacer between the fiber 60 and the lens 62, it is apparent that there is no disclosure or suggestion of the length (Dm) of the glass 61 between the lens 62 and an input plane of the fiber 60 being selected based on an eye opening factor of the fiber 60 and a power of radiation transmitted by a light source. Instead, the length (Dm) of the glass

61 is determined by other factors so as to achieve the formation of the real image and the focusing of the optical energy at a point. As a result, Marcuse also fails to disclose or suggest this feature of claim 1.

Cunningham discloses a number of experimental results achieved from a system having a laser coupled to a single mode fiber and a multimode fiber coupled to the opposite end of the single mode fiber. The experiment includes offsetting axially the center of the core of the single mode fiber from the center of the core of the multimode fiber to various degrees to determine the effect on light transmission. The experimental results are detailed in a number of eye diagrams. (See column 8, lines 3-31 and Figures 7a-7e).

In the rejection, it is indicated that the disclosure of the eye diagrams in Cunningham supports the position that the claimed feature of the predetermined distance being selected based on an eye opening factor of the multi-mode fiber and a power of the optical signal is obvious to one of ordinary skill in the art. However, it is submitted that this disclosure of Cunningham fails to support the position of obviousness of the above-discussed claimed feature.

Initially, it is noted that although the experimental results of Cunningham are detailed in "eye" diagrams, the experiments themselves are specifically disclosed as relating to axially offsetting the core of the multimode fiber from the core of the single mode fiber to measure light transmission through the multimode fiber. Cunningham fails to disclose or suggest that the experimental results are in any way related to a distance between a vertex of a lens and the input plane of the multimode fiber. As a result, it is apparent that Cunningham does not suggest the claimed feature of the predetermined distance being selected based on the eye opening factor of the multi-mode fiber and the power of the optical signal.

In consideration of the above discussion, Forrest, Marcuse and Cunningham do not, either alone or in combination, disclose or suggest the claimed feature of the predetermined distance being selected based on the eye opening factor of the multi-mode fiber and the power of the optical signal. Therefore, one of ordinary skill in the art would not have been motivated to modify or combine the references so as to obtain the invention as recited in claim 1.

As for claim 3, it is patentable over the combination of Forrest, Marcuse and Cunningham for

reasons similar to those discussed above in support of claim 1. That is, claim 3, like claim 1, recites, in part, at least one lens having a vertex located at a predetermined distance from an input plane of a multi-mode fiber, the predetermined distance being selected based on an eye opening factor of the multi-mode fiber and a power of the optical signal, which feature is not disclosed or suggested by the references.

Claim 6 is patentable over the combination of Forrest, Marcuse and Auracher, since claim 6 recites an optical transmission system having, in part, a receiver with a receptacle for connecting to a multi-mode fiber to affix an output plane of the multi-mode fiber at a predetermined distance from a light-receiving plane of a light receiving element, wherein the predetermined distance is determined based on a core diameter of the multi-mode fiber, a diameter of the light-receiving plane, and a maximum angle among angles of modes of the optical signal outputted from an output plane of the multi-mode fiber which are capable of entering the light-receiving plane. The combination of Forrest, Marcuse and Auracher fails to disclose or suggest these features of claim 6.

As discussed above, Forrest discloses the photodiode 22 having the active region 26 for receiving radiation from the fiber 14. (See Figure 2). However, as admitted in the rejection, Forrest fails to disclose or suggest a receptacle for connecting the fiber 14 to one of the terminals 10 and 12 at a predetermined distance, whereby the predetermined distance is determined based on a core diameter of the fiber 14, a diameter of the active region 26, and a maximum angle among angles of modes of the radiation outputted from the fiber 14 which are capable entering the active region 26 of the photodiode 22. As a result, Marcuse or Auracher must disclose or suggest these features in order for the combination of Forrest, Marcuse and Auracher to render claim 6 obvious.

As discussed above, Marcuse discloses the glass 61 that acts as a spacer between the fiber 60 and the lens 62. Further, Marcuse discloses a formula which defines the length (Dm) of the glass 61 in relation to a radius (a) of a core 63 of the fiber 60, a radius (b) of the glass 61, and a refractive index of the glass 61. (See column 3, line 2 – column 4, line 31 and Figure 6). While Marcuse does define the length (Dm) of the glass 61 between the fiber 60 and the lens 62 based on the factors detailed above, it is apparent that these factors do not include the maximum angle among angles of modes of the optical signal outputted from an output plane of the fiber 60 which are capable of

entering a light-receiving plane. Further, it is apparent that Marcuse fails to disclose or suggest the claimed receptacle and instead relies on the fusion of the glass 61 to the fiber 60 and the lens 62. As a result, Marcuse also fails to disclose or suggest these features of claim 6.

As for Auracher, it discloses a mode transducer that is capable of converting a specific mode to another mode, or blocking or passing one or more modes. (See column 1, lines 30-35). However, it is clear that although the transducer is capable of selecting different modes, Auracher provides no disclosure or suggestion of determining a predetermined distance between an output plane of a multi-mode fiber based on a maximum angle among angles of modes of an optical signal outputted from the output plane of the multi-mode fiber which are capable of entering the light-receiving plane. Further, Auracher also fails to disclose or suggest the claimed receptacle.

In consideration of the above discussion, Forrest, Marcuse and Auracher do not, either alone or in combination, disclose or suggest the claimed features of the receptacle for connecting to the multi-mode fiber to affix the output plane of the multi-mode fiber at the predetermined distance from the light-receiving plane of the light receiving element, wherein the predetermined distance is determined based on a core diameter of the multi-mode fiber, a diameter of the light-receiving plane, and a maximum angle among angles of modes of the optical signal outputted from an output plane of the multi-mode fiber which are capable of entering the light-receiving plane. Therefore, one of ordinary skill in the art would not have been motivated to modify or combine the references so as to obtain the invention as recited in claim 6.

As for claim 8, it is patentable over the combination of Forrest, Marcuse and Auracher for reasons similar to those discussed above in support of claim 6. That is, claim 8, like claim 6, recites, in part, a receiver having a receptacle for connecting to a multi-mode fiber to affix an output plane of the multi-mode fiber at a predetermined distance from a light-receiving plane of a light receiving element, wherein the light-receiving element receives a lower order mode of an optical signal and a higher order mode of the optical signal is prevented from entering the light-receiving plane, and the predetermined distance is determined based on a core diameter of the multi-mode fiber, a diameter of the light-receiving plane, and a maximum angle among angles of modes of the optical signal outputted from the output plane which are capable of entering the light-receiving plane, which

features are not disclosed or suggested by the references.

As for claim 11, it is patentable over references relied upon in the rejections for reasons similar to those discussed above with respect to claim 1 and claim 6.

Because of the above-mentioned distinctions, it is believed clear that claims 1-11 are patentable over the references relied upon in the rejections. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention would not have been motivated to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 1-11. Therefore, it is submitted that claims 1-11 are clearly allowable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

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